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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
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10/712,017

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Minoru Watanabe

OKI 387

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23995

7590

03/23/2005

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EXAMINER

TRINH, MICHAEL MANH

ART UNIT

PAPER NUMBER

2822

DATE MAILED: 03/23/2005

Please find below and/or attached an Office communication concerning this application or proceeding.

Office Action Summary

Application No.

10/712,017

Applicant(s)

WATANABE ET AL.

Examiner

Michael Trinh

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-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If the period for reply specified above is less than thirty (30) days, a reply within the statutory minimum of thirty (30) days will be considered timely.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

- 1) ☒ Responsive to communication(s) filed on 14 November 2003.
- 2a) ☐ This action is **FINAL**. 2b) ☒ This action is non-final.
- 3) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

- 4) ☒ Claim(s) 1-13 is/are pending in the application.
- 4a) Of the above claim(s) _____ is/are withdrawn from consideration.
- 5) ☐ Claim(s) _____ is/are allowed.
- 6) ☒ Claim(s) 1-13 is/are rejected.
- 7) ☐ Claim(s) _____ is/are objected to.
- 8) ☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

- 9) ☐ The specification is objected to by the Examiner.
- 10) ☐ The drawing(s) filed on _____ is/are: a) ☐ accepted or b) ☐ objected to by the Examiner.
Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).
Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).
- 11) ☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

- 12) ☒ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
- a) ☒ All b) ☐ Some * c) ☐ None of:
1. ☒ Certified copies of the priority documents have been received.
2. ☐ Certified copies of the priority documents have been received in Application No. _____.
3. ☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).
- * See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

- 1) ☒ Notice of References Cited (PTO-892)
- 2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
- 3) ☒ Information Disclosure Statement(s) (PTO-1449 or PTO/SB/08)
Paper No(s)/Mail Date 11/14/03 & 5/19/04.
- 4) ☐ Interview Summary (PTO-413)
Paper No(s)/Mail Date. _____.
- 5) ☐ Notice of Informal Patent Application (PTO-152)
- 6) ☐ Other: _____.

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DETAILED ACTION

*** This office action is in response to filing of the application on November 14, 2003.

Claims 1-13 are pending.

Claim Rejections - 35 USC § 112

1. Claim 4 is rejected under 35 U.S.C. 112, second paragraph, as being indefinite for failing to particularly point out and distinctly claim the subject matter which applicant regards as the invention.

Re claim 4, meaning and scope of “the first energy beam is applied partially to the repetitive portion of the first resist pattern in the lump” are unclear and indefinite. First, as differently recited in base claim 1, the first energy beam is applied to the first resist film, not the first resist pattern. Second, the limitation “...partially to the repetitive portion” is lacking proper antecedent basis, and unclear for what makes the beam applied partially (also noted that the specification apparently fails to mention and describe this).

Specification

2. Accordingly, the specification is objected to as failing to provide proper antecedent basis for the claimed subject matter in claim 4. See 37 CFR 1.75(d)(1) and MPEP § 608.01(o). Appropriate correction is required.

3. Specification page 13, last 5 lines, is objected for having typographical errors, since as shown in Fig. 3(a), “silicon oxide film 202” should be --silicon oxide film 201--, and “semiconductor substrate 201” should be --semiconductor substrate 202--.

Appropriate correction is required.

Claim Rejections - 35 USC § 103

4. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person

having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negated by the manner in which the invention was made.

This application currently names joint inventors. In considering patentability of the claims under 35 U.S.C. 103(a), the examiner presumes that the subject matter of the various claims was commonly owned at the time any inventions covered therein were made absent any evidence to the contrary. Applicant is advised of the obligation under 37 CFR 1.56 to point out the inventor and invention dates of each claim that was not commonly owned at the time a later invention was made in order for the examiner to consider the applicability of 35 U.S.C. 103(c) and potential 35 U.S.C. 102(f) or (g) prior art under 35 U.S.C. 103(a).

5. Claims 1-9 are rejected under 35 U.S.C. 103(a) as being unpatentable over Sachiko et al (JP-11-168052) taken with Takamitsu (JP-2001-274062).

Sachiko teaches process for forming a pattern comprising: preparing a substrate; forming a workpiece film 1 on the surface of the substrate (English translation, paragraphs 2,7, and 0031), forming a resist film 2 on top of the workpiece film 1 (Figs 1a-1f, paragraph 0019); disposing a mask 8 on the surface of the substrate, and irradiating the resist film with a first energy beam through the mask (Fig 1b; paragraph 20); forming a first resist pattern 12 on the surface of the substrate by developing the resist film after applying the first energy beam (Fig 1d, paragraph 21); irradiating the first resist pattern with a second energy beam after removal of the mask 8 (Fig 1e; paragraph 22); forming a second resist pattern smaller than the first resist pattern by subjecting the first resist pattern to heat treatment during the application of the second energy beam (Fig 1f; paragraphs 22-23,14); and patterning the workpiece film by use of the second resist pattern as a mask to form pattern line (paragraphs 2,7, and 31). Re claim 2, wherein the first energy beam is excimer laser beam (paragraph 0020; Fig 1b). Re claim 3, wherein the resist film 2 is a positive chemically amplified resist (paragraph 20). Re claim 4, wherein the first energy beam is applied partially to the repetitive portion of the first resist pattern/film in a lump; insofar as understood, as shown in Figs. 1b-1e and paragraphs 19-30, the first energy beam is partially applied to plurality portions of the first resist film in a lump with a mask thereon. Re claims 5-6, wherein the second energy beam is an ultraviolet radiation (Fig 1e, paragraph 0022), wherein irradiation with the second energy beam causes a crosslink

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reaction to polymer material of the chemical amplifying resist pattern (Abstract, paragraphs 12-16,19-22).

Sachiko teaches heating the first resist pattern during irradiation of the second energy beam; whereas, base claim 1 recites heating the resist pattern after applying of the second energy beam.

However, Takamitsu teaches (at English abstract; Figs 1A-1E) heating the resist pattern after application of the second energy beam by subjecting the resist pattern to a high temperature baking treatment.

Therefore, the subject matter as a whole would have been obvious to one of ordinary skill in the art at the time the invention was made to form a pattern of Sachiko by performing the heat treatment of the resist pattern after application of the second energy beam by using an ultraviolet radiation as taught by Takamitsu. This is because of the desirability to have more separate controls for each of the irradiation step and the heating step so that forming of the pattern can be performed in an effective manner.

Re further claims 7-8, Sachiko already teaches (at paragraph 23) forming a smaller second resist pattern by heating and irradiating the first resist pattern with the second energy beam, wherein heating is performed in a range of heating temperature, wherein the second energy beam is an ultraviolet radiation (Fig 1e, paragraph 0022). Thus, re claims 7-8, Sachiko thus does not detail determining a heating temperature from a relationship between the heat temperature and the size shrinkage. However, Takamitsu also teaches (at Figs 4, 5-6; paragraphs 57-61) determining a relationship between heating temperature and the size of the first resist pattern after the first resist pattern was subjected to a heat treatment, wherein a particular heating temperature in the heat treatment can be determined and selected by the relationship between the heating temperature and the size of the resist pattern.

Therefore, it would have been obvious to one of ordinary skill in the art at the time the invention was made to determine a heating temperature for heating the first resist pattern of Sachiko by predetermining a particular heating temperature selected from a relationship between heating temperature and the size of the first resist pattern after the first resist pattern was subjected to a heat treatment, as taught by Takamitsu, This is because of the desirability to determine an appropriate heating temperature in the heat treatment of the first resist pattern so

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that a desired size of the resist pattern can be predetermined. Irradiating the first resist pattern with the second energy beam of ultraviolet radiation, as taught by Sachiko and Takamitsu, or known electron beam, causes crosslink of polymer material of the resist pattern. Furthermore, the subject matter as a whole would have been obvious to one of ordinary skill in the art at the time the invention was made to perform a routine experimentation to determine a relationship range between temperature and size, and to select the portion of the range, because it has been held to be obvious to select a value in a known range by optimization for the best results, and would be an unpatentable modification, where the general conditions of a claim are disclosed in the prior art, it is not inventive to discover the optimum or workable ranges by routine experimentation". *In Re Aller* 104 USPQ 233,255 (CCPA 1955); *In re Waite* 77 USPQ 586 (CCPA 1948); *In Re Swanson* 56 USPQ 372 (CCPA 1942); *In Re Sola* 25 USPQ 433 (CCPA 1935); and *In Re Dreyfus* 24 USPQ 52 (CCPA 1934).

6. Claim 9-13 are rejected under 35 U.S.C. 103(a) as being unpatentable over Sachiko et al (JP-11-168052) taken with Takamitsu (JP-2001-274062), as applied above to claims 1-8, and further of Koji (JP-2002-164302).

The references including Sachiko and Takamitsu teach process for forming a pattern as applied to claims 1-8 above. Re claim 9, Sachiko also teaches forming the first and second resist pattern as pattern lines 12,16 in the manufacture of semiconductor device, which pattern lines are substantially linear (Figs 1A-1e; paragraphs 0001,0002).

Re claims 10-11, Sachiko lacks mentioning the use of the patterned workpiece film as a mask in doping to form a MOSFET, wherein the patterned workpiece film is a gate electrode of the MOSFET. Re claims 12-13, Sachiko lacks mentioning the use of the patterned workpiece film as a wiring to electrically connected to the semiconductor device.

Re claims 10-11, Koji teaches (at Figs 1e,2a-2d) patterning a workpiece film by use of a resist pattern 34 as a mask (Fig 1e; paragraph 0013,0011-0012), wherein the patterned workpiece film 9,11 is used as a mask during doping the surface of the substrate with impurity thereby forming a MOSFET on the surface of the substrate (Figs 2c-2d, paragraph 0014), and wherein the patterned workpiece film 9,11 is a gate electrode 9,11 of the MOSFET (Figs 1e-2d,3d, paragraphs 11,13 and 14). Re claims 12-13, Koji also teaches patterning a workpiece

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film by use of a resist pattern 40 as a mask (Fig 3c, paragraph 0017-0019), wherein the patterned workpiece film 15-18 is used as a wiring to electrically connected to the semiconductor device.

Therefore, it would have been obvious to one of ordinary skill in the art at the time the invention was made to employ a smaller second resist pattern of Sachiko to pattern a workpiece film and to use of the patterned workpiece film as a mask in doping to form a MOSFET, wherein the patterned workpiece film is a gate electrode of the MOSFET, and to use of the patterned workpiece film as a wiring to electrically connected to the semiconductor device, as taught by Koji. This is because of the desirability to form a smaller MOSFET semiconductor device by employing the smaller resist pattern, thereby higher density of integrated circuit including a plurality of small semiconductor devices can be fabricated. Re further claim 9, forming the resist pattern having a linear or dotted shape would have been obvious to one of ordinary skill in the art, because at least of the desirability to employ the resist pattern as a mask in forming a wiring runner or a wiring via plug in a contact hole of a MOSFET semiconductor device.

Any inquiry concerning this communication or earlier communications from the examiner should be directed to Michael M. Trinh whose telephone number is (571) 272-1847. The examiner can normally be reached on M-F: 8:30 Am to 5:00 Pm.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Amir Zarabian can be reached on (571) 272-1852. The fax phone number is (703) 872-9306.

Any inquiry of a general nature or relating to the status of this application should be directed to the receptionist whose telephone number is (703) 308-0956.

Oacs-102



Michael Trinh
Primary Examiner